RHYTHM® Inventory Planner

i2 Technologies

Table of Contents

Inventory Planning Process

Inventories are a fundamental part of any supply chain. Given that there are inherent variations in *demand* (volume and mix), *process* (yield, machine downtimes, transportation reliabilities), and *supply* (part quality, delivery reliabilities), inventory planners carry *safety stock* to protect the supply chains from these variations and to provide the desired level of customer service within the cost constraints.

Inventory Planning is a business planning process that helps users:

- Efficiently and effectively manage their inventory

- Formalize their inventory controls

- Analyze safety stock in terms of the variability due to demand, process and supply

- Carry out "what-if" simulations that allow them to foresee effects of changing market conditions, technology, management policies, product line, and supply chain structure, on investment in inventory and the quality of service provided to their customers

- Address their tactical as well as strategic needs

With rapid changes in technology, market place, and product line, the key to a business's success is to consistently anticipate versus react. The inventory planning process provides management with the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by putting the *right product* in the *right place* at the *right time*, subsequently *maximizing return on assets*. This process is performed at least once a month and is reviewed by management at an aggregate (product family) level.

Client Profile

RHYTHM Inventory Planner (IP) offers a complete inventory planning solution that encompasses *industry segments* such as consumer goods, retail, semiconductor, telecommunication, pharmaceutical, chemical, metals, apparel, defense, automotive and spare parts, and *user environments* which are make-to-stock, make-to-order, configure-to-order, or a combination of any of the above.

RHYTHM IP addresses the inventory planning needs of different *departments* (including manufacturing, engineering, sales/marketing, and finance) and the entire *organizational* hierarchy (from material/procurement managers, master schedulers, warehouse managers, and demand planners to upper management) with easy-to-use tools and reports that provide analysis at different levels of abstraction.
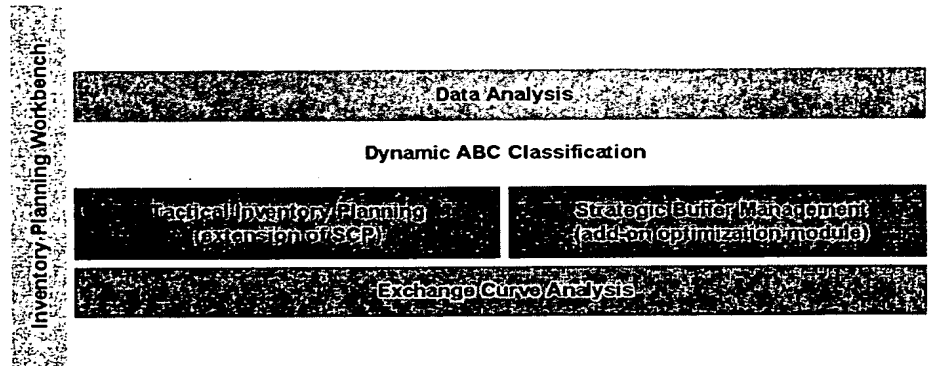
RHYTHM IP Objective

RHYTHM IP's main objective is to provide the users with an *intuitive* workflow that captures all the steps required to perform various inventory planning activities.

These activities include:

- Data Analysis
- ABC Classification
- Formalized Inventory Controls
- Safety Stock Computation
- Tactical Inventory Planning
- Strategic Inventory Planning
- Exchange Curve Analysis
- Integration and Evaluation of the Inventory Plan with Supply Chain Operational and Execution Level Master Plans

RHYTHM IP's functionality can be graphically summarized as follows:

Data Analysis

Dynamic ABC Classification

Tactical Inventory Planning (extension of SCP)

Strategic Buffer Management (add-on optimization module)

Exchange Curve Analysis

Inventory Planning Workbench

Current Product Features

RHYTHM IP is a decision-support tool that helps users efficiently and effectively manage their inventory.

The RHYTHM IP workbench facilitates the following inventory planning workflow:
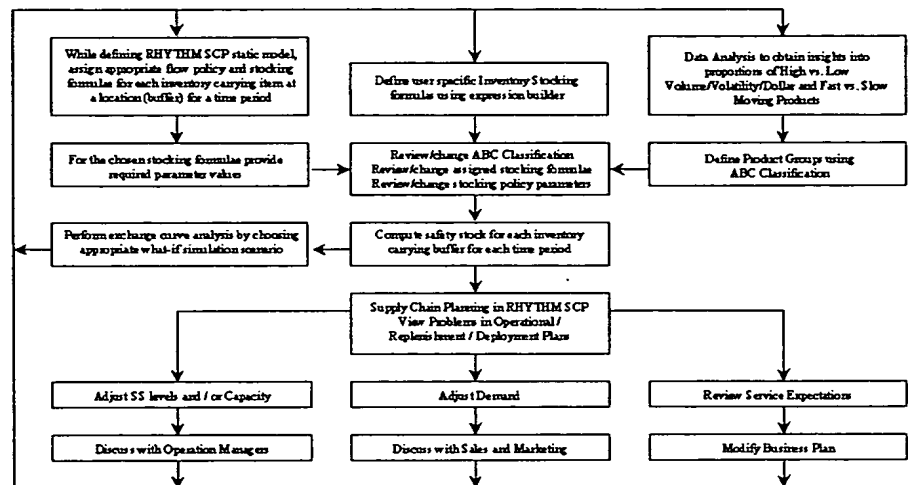
Data Analysis

RHYTHM IP's extensive data analysis helps identify proportions of

- Fast versus Slow Moving Items
- High versus Low Volatility Items
- High versus Low Sales Volume Items
- High versus Low Sales Dollar Items
- High versus Low Cost Items
- High versus Low Margin Items

Data analysis provides the users key insight into narrowing their focus to inventories that need the most planning improvement. It also helps identify the appropriate ABC classes.

ABC Classification

Typically, a supply chain contains thousands of items, and as a result, numerous stock keeping units (SKUs).

RHYTHM IP's ABC classification allows the users to classify items with similar characteristics into multi-level group hierarchies and apply the same inventory controls, such as replenishment schedule and fill rate, to all items in a given group.
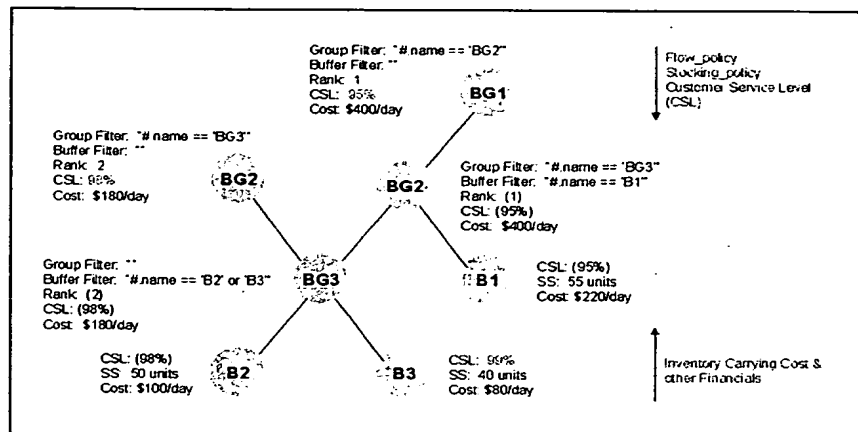
Different departments can classify the same set of items in different ways. RHYTHM IP's flexible and easy-to-use item classification combined with comprehensive data analysis capability helps users simulate extensive "what-if" scenarios.

Users can import existing *a priori* groups or they can classify items using the following method:
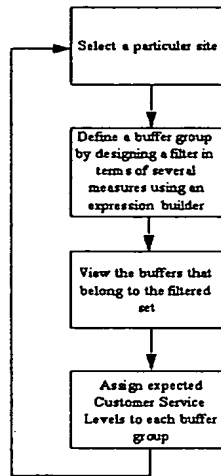
- change the item mix of a group in real time by interactively modifying *filter* expressions based on any number of item attributes

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- PGI consists of "all buffers except P24 with cost > $1000 and $volume per year ~ 2M and critical index = 0.9 ...requiring 90% CSL"

Product Group		Dimensions			Measures					Customer
Name	Description	Time Interval	Geography	Customer	Cost $	$ Val /year	Filter Products	Forecast	Critical Index	Service Level
PO I	I	01.01.97 – 04.01.97	North-East	Wally	> 1000	2M	P24	3200	0.9	0.9
PO II	II	01.01.97 – 04.01.97	South-West	Wally	<= 2500	10K	P90, P91	20000	0.99	0.8
PO III	III	01.01.97 – 04.01.97	North-West	Wally	> 1000	25M	P12	50000	0.8	0.7
PO IV	IV	01.01.97 – 04.01.97	West Coast	Wally	<= 9000	20K	P14, P15	90000	0.5	0.5
PO V	V	01.01.97 – 04.01.97	North-East	Kmart	> 10000	30M	P93, P22	8000	1.0	0.9
PO VI	VI	01.01.97 – 04.01.97	South-West	Kmart	> 1000	30K	None	10000	0.8	0.6
PO VII	VII	01.01.97 – 04.01.97	South-West	Kmart	> 2000	80K	P34	9000	0.9	0.9

Formal Inventory Controls

Inventory controls are procedures for managing the flow of material through each inventory carrying point of the supply chain. They manage the replenishments (inflow), safety stock (inventory), and allocations (outflow). Inventory controls play a key role in successful supply chain management.

While informal inventory controls (based on experience and judgment of planners) might be sufficient for industries whose environment remains stable, they are inefficient for industries whose environment changes rapidly. Typically informal inventory controls either result in insufficient inventory causing a decrease in revenue (loss of sales, long order backlogs, and poor customer satisfaction) or surplus inventory causing additional expense (inventory carrying cost and cost of depreciation of that inventory).

RHYTHM IP's formal inventory controls are systematic ways to compute safety stocks and predict inventory positions by taking into account management policies, customer service expectations, inventory carrying costs, and patterns (user-defined discrete or continuous distributions), and statistical measures of different historical and forecasted variables for demand, process, and supply. These mechanisms help users maximize customer service performance with minimum inventory investment.
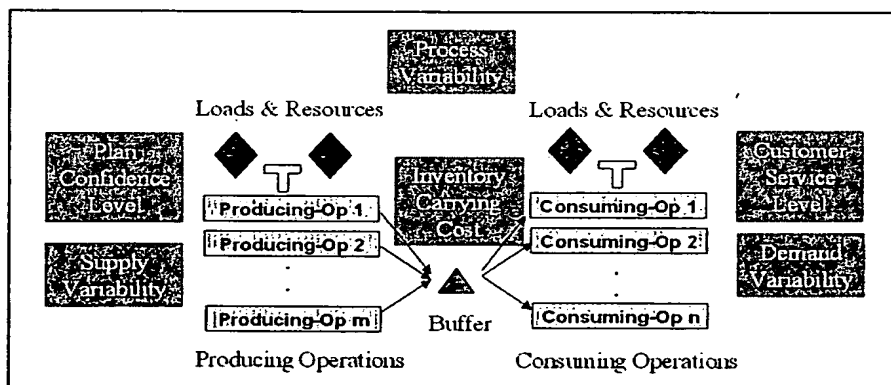
Tactical Inventory Planning

RHYTHM IP helps users with their tactical inventory planning, which is to determine exactly *how much* safety stock to carry at a given point in the supply chain. It provides a set of pre-defined formulas for computing *time-phased* safety stock in terms of *quantity or time of coverage*. Safety stock can further be analyzed due to *demand- or supply-only variability,* helping users suggest improvements in specific supplier performance and/or sales forecast. Users can also either *bias* the result of the pre-defined formulas or *override* them with their own. This flexibility allows the users to define *hybrid* inventory controls that rely both on the theoretical approaches and their practical domain insights.

Tactical Inventory Planning is available as an extension of RHYTHM SCP.
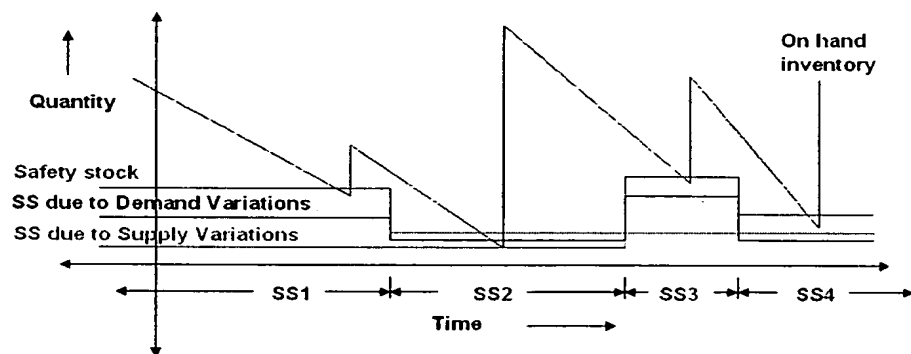
Formulations

* Given target customer service level determine target safety stock

Inverse Formulations

* Given current SS determine achievable CSL

Data Requirements

Possible Input Variables

- mean demand rate
- standard deviation in demand
- distribution of demand over lead time
- mean lead time
- standard deviation in lead time
- mean replenishment interval
- mean replenishment quantity (lot size)
- inventory carrying cost
- user bias (forecast error)
- customer service level

Output Variable

- safety stock (can be separated due to demand and supply)

Variables can be scalars (fixed) or vectors (time varying).
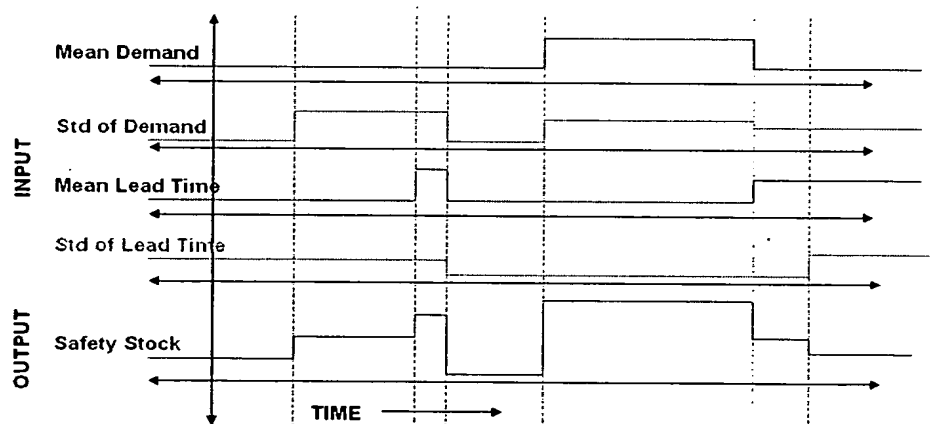
Strategic Buffer Management

Inventories stored at different points along the supply chain have differing issues:

*   impact on the *cost* (higher value for carrying finished goods)

*   degrees of *flexibility* (higher flexibility in transforming raw materials into alternative finished goods)

*   levels of *responsiveness* (higher customer service can be achieved by shipping finished goods to customers without delay)
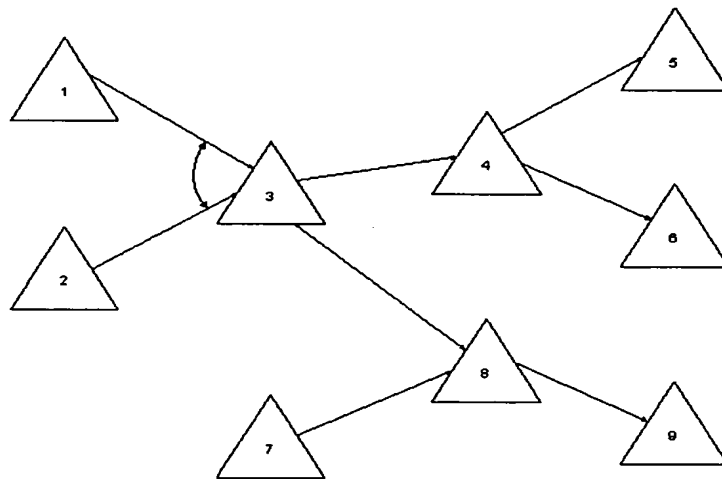
RHYTHM IP's strategic planning functionality considers these conflicting issues and recommends not only *how much* but also *where* in the supply chain to carry safety stock. It provides a set of advanced algorithms that optimize customer service performance weighing cost impact of carrying inventory at different locations. It is *scalable* from single-site to multiple-enterprise supply chain networks.

Strategic Buffer Management (SBM) coupled with advanced supply chain operational and execution planning results in the *right item* in the *right place* at the *right time*, subsequently resulting in not only *minimizing cost* but also *maximizing revenue.*

SBM is available as an add-on RHYTHM optimization module.

Exchange Curve Analysis

RHYTHM IP's Exchange Curve Analysis is a set of simulation scenarios that helps users graphically analyze *quantitative* and *qualitative* effects of incorporating different inventory controls, including *tradeoffs* between different inventory investment and customer service options.

The following depicts capital investment in stock versus annual value of back orders for different customer service options.
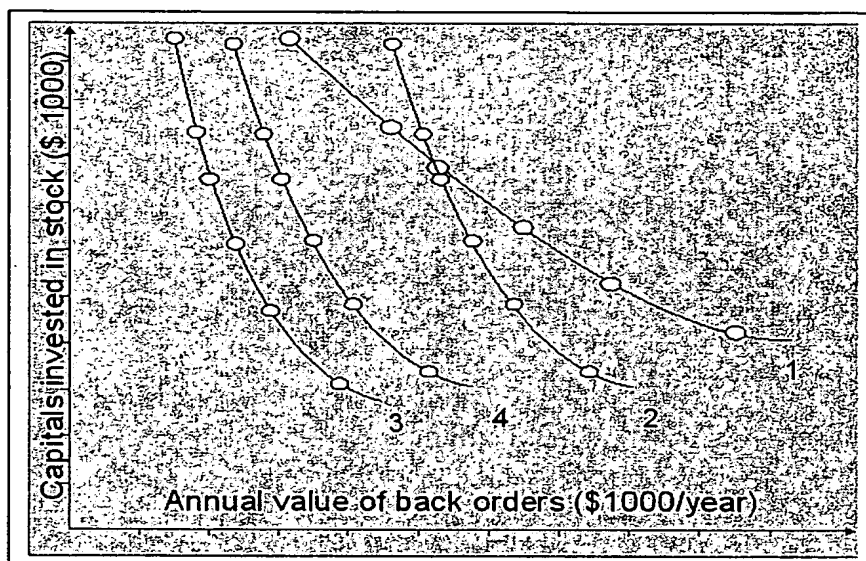
System Architecture and Integration

RHYTHM IP is currently available with RHYTHM SCP (i2's advanced supply chain planning product). RHYTHM IP's tactical and strategic inventory planning functionality enhances RHYTHM SCP's powerful supply chain representation, operational planning, and exception reporting capability. RHYTHM IP also interfaces with demand planning engines (such as RHYTHM Demand Planner) and performance tracking engines (such as RHYTHM Sales and Operations Planner and RHYTHM Reporter) for demand forecast and variability in demand and supply (actual versus planned historical information).
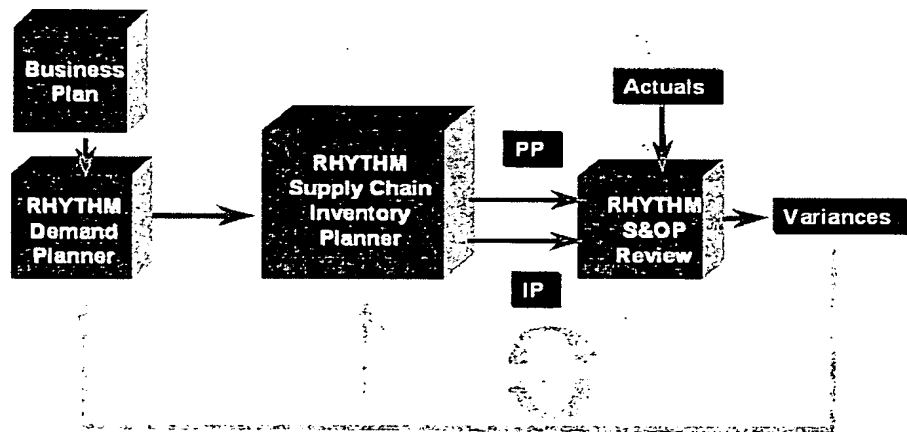
Product Benefits

RHYTHM IP offers a complete inventory planning solution that encompasses make-to-stock, make-to-order, and configure-to-order users, and addresses their tactical as well as strategic planning needs. Some of its key benefits are as follows:

Benefit Summary

- RHYTHM IP's extensive data analysis helps identify proportions of high-versus low-volume/dollars/volatility and fast versus slow moving items. This analysis provides the users key insight into narrowing their focus to inventories that need the most planning improvement.

- RHYTHM IP's flexible and easy-to-use item classification combined with data analysis capability helps users simulate comprehensive "what-if" scenarios.

- RHYTHM IP's Exchange Curve Analysis helps users graphically analyze *quantitative* and *qualitative* effects of incorporating different inventory controls, including *tradeoffs* between different inventory investment and customer service options.

- RHYTHM IP's formal inventory control mechanisms help users maximize customer service performance with minimum inventory investment. Its tactical inventory planning helps determine exactly *how much* safety stock to carry at any given point in the supply chain. *Time-phased* safety stock is computed in terms of *quantity or time of coverage.*

- Safety stock can further be analyzed due to *demand- or supply-only variability,* helping users suggest improvements in specific supplier performance and/or sales forecast.

- Users can also either *bias* the result of the pre-defined formulas or *override* them with their own. This flexibility allows the users to define *hybrid* inventory controls that rely both on the theoretical formulas and their practical domain insights.

- RHYTHM IP's Strategic Buffer Management module recommends not only *how much* but also *where* in the supply chain to carry safety stock. It provides a set of advanced algorithms that optimize customer service performance weighing cost impact of carrying inventory at different locations. It is *scalable* from single-site to multiple-enterprise supply chain networks.

- RHYTHM IP's strategic inventory planning coupled with advanced supply chain operational and execution planning results in the *right item* in the *right place* at the *right time,* subsequently resulting in not only *minimizing cost* but also *maximizing revenue.*

- RHYTHM IP is tightly integrated with advanced planning engines such as RHYTHM Supply Chain Planner, RHYTHM Demand Planner, RHYTHM Sales and Operations Planner, and RHYTHM Reporter.